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Educational Attainment and Vocational/Technical Training: Questionnaire Design and Data Quality

Anna Y. Chan
Jeffrey C. Moore

Statistical Research Division
U.S. Census Bureau
Washington, DC 20233

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Anna Y. Chan and Jeffrey C. Moore
U.S. Census Bureau, Washington, DC 20233-9100.

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Key words: educational attainment, vocational/technical training, measurement design and data quality

Introduction and Overview

The educational level of Americans has risen substantially in the last 60 years (U.S. Census Bureau 2002). In 1940, formal schooling for most adults ended before high school graduation; at that time only 24% of adults age 25 and over had completed high school. Over the next 25 years, by the mid 1960s, that proportion reached the 50% level. By 2002, the high school completion level of adults of that age group had reached 84%, while the college completion level was 26%.

Over this same time period the wording and format of "standard" educational attainment questions also changed to better reflect the educational and training experiences of Americans, and to improve the quality and usefulness of education data. Prior to 1940, for example, educational attainment was typically measured in terms of literacy, by simply asking the respondent whether he or she could read and write. In the 1940 Decennial Census, the U.S. Census Bureau measured educational attainment by collecting the highest grade or year of regular school completed. In 1980s, researchers began to realize that years of schooling completed could not necessarily be equated with degree attainment, and that assumptions to that effect were subject to important error. For example, it was estimated that between 7% and 13% of persons reporting having completed 16 or more years of school did not have a Bachelor's degree (U.S. Census Bureau, 1996). Thus, the Census Bureau added degree completion to its standard attainment question, as in the following question from the 1990 Decennial Census: "What is the highest level of school you have completed or the highest degree you have received?"

Over the last two decades, educational attainment in the United States has continued to be a moving target. "Credential" or non-degree programs have attained increased prominence in our post-secondary education system. For example, the American Association of Community Colleges (AACS) reported that in 1997 nearly half of all undergraduate enrollment in U.S. community colleges consisted of students participating in non-credit programs. With the completion of high school approaching nearly universal levels, the Census Bureau and other federal agencies have begun to focus on improved measurement of both non-'regular' vocational/technical training, and 'regular' schooling beyond high school.

Survey Measurement Design Issues

As with all survey content areas, measurement design can have important impacts on the quality of measurement outcomes. This paper examines a redesigned approach to survey measurement of educational attainment and vocational/technical training in the context of the Census Bureau's automated Survey of Income and Program Participation (SIPP) questionnaire. The research described here addresses two design issues specific to these content areas. The first has to do with the difficulty of assigning an appropriate rank order – "the highest level of school you have completed" – to educational experiences that are outside of the 'regular school' continuum. The second issue is much more mundane: how to reconcile the need for the wide range of response options necessary for precise measurement of attainment with the very limited space available on a typical laptop computer screen.

Difficulty and Inappropriateness of Listing Vocational Attainment in a Continuum

Traditionally, questions on educational attainment have applied only to progress in "regular" schools – graded elementary, junior, and senior high schools, colleges, universities, and professional schools, whose curricula advance a person toward a certificate, diploma, or professional school degree. The advantage of restricting education questions to this particular universe is that the regular/traditional schooling system forms a natural hierarchy. There is wide consensus on the notion of an upward progression on the attainment hierarchy as one proceeds from elementary school certificate, to high school diploma, to associate degree, to bachelor's degree, to master's, and to doctorate. Nontraditional education, such as that which leads to various types of vocational, technical, occupational, or business certificates, stands outside the standard educational hierarchy, and thus presents measurement and analytic difficulties. Such schooling is generally counted in the regular school hierarchy only if the credits obtained are transferable to a regular school. But these programs very often do not fit into the traditional scale as we understand it.

The current format of the SIPP 2001 panel instrument's educational attainment question – in particular, response category 41 ("Diploma or certificate from a vocational, technical, trade or business school beyond the High School level") (see Appendix A left-most column) – presents a number of potential problems for interviewers and respondents, chief among them are: first, it is not immediately evident where such training fits into the standard attainment continuum (or even if it does); and second, that there is no clear guidance for a person who has a substantial amount of such training to report, but no diploma/certificate. A related byproduct of trying to include nontraditional education in the traditional education hierarchy is that doing so almost guarantees that some people's experiences will escape detection – for example, those who have also advanced substantially through the regular/traditional system. Thus, the current arrangement does not yield complete statistics on the prevalence of vocational training.

To resolve these issues, and to enable SIPP to capture more detailed and useful data about vocational training, we removed the "Diploma or certificate from a vocational, technical..." option from the main attainment screen in our test instrument. We intend to improve the educational attainment data by branching off the "standard" hierarchy scale and measuring vocational training without adding the concept to the main attainment question. We added two new questions specifically focused on such training: a screening question about "ever attending" a vocational/technical/trade or business school, and a follow-up question about receipt of a certificate or diploma from such a school.

Reduce Screen Clutter

The second questionnaire design issue focused on methods for reducing the "clutter" of the educational attainment screen. Anecdotal evidence from the field has long suggested that, in the often untidy circumstances of a live interview, even experienced interviewers can have difficulty finding the correct match for respondents' reports from among the available options, especially if the response indicates a fairly uncommon attainment status. There are a great many response options – 17 – very few of which are brief and easily "scannable," and many of which are accompanied by a fair amount of explanatory text and definitions. The extent to which the cluttered screen contributes to measurement error is unknown, but the risks are obvious.

Methodology

A larger methodological research project embedded in the Census Bureau's Survey of Income and Program Participation served as the vehicle for this particular research effort. Below we briefly describe the research context and the main features of the educational attainment experiments.

The Survey of Income and Program Participation (SIPP)

SIPP is a complex longitudinal survey conducted by the U.S. Census Bureau. It provides data on the distribution of income, wealth and poverty in the United States, and other topics such as government program participation and eligibility, labor force participation and health insurance coverage. Results from the survey have far-reaching implications for national policy. See U.S. Census Bureau (2001) for a more detailed description of the SIPP program.

The SIPP Methods Panel

In 1996, the Census Bureau established the Continuous Instrument Improvement Group (CIIG), consisting of staff from numerous Census Bureau technical, program, and subject-area research divisions, and led by survey methodologists. CIIG's task was to review the SIPP core instrument and recommend changes to improve the instrument and reduce burden. The need for thorough and rigorous testing led CIIG to recommend the creation of a "methods panel," separate from and parallel to the production SIPP survey. The centerpiece of the Methods Panel (MP) project is a series of field experiments designed to support rigorous testing of the proposed new, alternative instrumentation with the intention that the third field test contains the final version of the revised and improved instrument.

The Methods Panel project carried out its initial field test on the Wave 1 core instrument in two rotations, August and September of 2000 (MP2000). The two subsequent field tests (MP2001 and MP2002) also included a Wave 2 interview conducted four months after the Wave 1 interview; these tests were carried out in July/August and November/December of 2001 (MP2001), and in June/July and October/November of 2002 (MP2002). Each field test drew a representative sample of households in six of the Census Bureau's twelve regional offices: Philadelphia, Kansas City, Seattle, Charlotte, Atlanta and Dallas, with each selected case randomly assigned either to a test group or a control group. Each household in the test group received a modified SIPP instrument containing experimental questions redesigned according to CIIG's recommendations. Each household in the control group received the current, standard SIPP 2001 panel instrument. Interviewers who conducted the MP interviews were all experienced SIPP interviewers who received special training on the new, experimental questions and procedures. See Doyle, Martin and Moore (2000) for a more detailed description of the Methods Panel project as a whole.

The sample for this research consists of 10,862 adults age 18 and over with a complete (or partially-complete) wave 1 personal interview in the MP2000 (n=3080), MP2001 (n=3372), or MP2002 (n=4410) field test. Revisions to the MP instruments were made between each field test.

Design of the Experimental Questionnaire

Both the test and the control treatment groups in our field tests were administered the identical question concerning educational attainment: "What is the highest level of school you have completed or the highest degree you have received?" The experimental manipulation concerned the inclusion or exclusion of the vocational/technical education category from the list of response options, and, if excluded, the position of the separate question concerning that form of education.

Control households in our tests were administered the standard, production SIPP questionnaire, which includes vocational/technical education as response category 41[2], in

[2] By long-standing practice, the numeric codes accompanying the educational attainment response options start at an arbitrary point, 31, in

approximately the middle position of the response option set. (See Appendix A, left-most column.) The test treatment questionnaires removed vocational/technical education from the response option set (see Appendix A, middle column), and substituted a separate question directed specifically at this form of education. In MP2000 and MP2002, the new vocational/technical education question followed the standard attainment question (See Appendix B); in MP2001 that order was reversed.

In MP2000, all test treatment respondents over age 18 who, in the main attainment question, reported less than an associate degree (response category 43[3]) were asked a follow-up vocational training question. In MP2001, where the vocational training question was placed prior to the main educational attainment question, we administered it to all test treatment respondents over age 18. In MP2002, the vocational training question was placed after the main attainment question again, and unlike MP2000, we administered the questions to all test treatment respondents over age 18 to obtain a full range of educational attainment of respondents with such training.

Reducing Screen Clutter

The second component of the research we conducted examined the impact of adding an initial screening question to determine whether the person completed high school or not, before presenting the standard attainment question. This permitted the final attainment screen to be split in half, depending on the answer to the screening, thus presenting a more manageable set of relevant response options – one for those who reported having completed high school, and the other set for those who reported otherwise. We tested this revised format in both the MP2000 and MP2001 field tests, using a split-panel experiment within the test treatment. In each field test, half of test treatment respondents received a new screener question, HSGRAD, prior to the standard attainment question, which asked each person whether he or she had completed high school (see Appendix A, far-right column). The attainment question which followed was essentially the same in both cases, but the response options began with high school graduate and proceeded up to doctoral degree in one case (YESGRAD), and began with less than 1st grade and proceeded to 12th grade with no diploma in the other (NOGRAD). The other half of test treatment cases received the standard attainment question (EDUCA), without the HSGRAD screener, and the full set of response options (minus the vocational/technical category). An "other" option, response category 48, was added in both test versions of the attainment question. All eligible test treatment respondents received the new vocational training questions.

Results

New Information on Vocational Training

In MP2001 and MP2002, we administered the vocational training questions to all 'test' treatment adults age 18 and over, and thus captured new information on the prevalence of vocational training, information not available in the standard all-on-one-screen educational attainment format. Over 20% of test treatment respondents reported having attended some vocational and technical school or training, with 75% of those respondents – 16.2% overall – reporting receipt of a diploma or certificate. This contrasts markedly with the control instrument, in which 3.3% of respondents reported a vocational/technical degree as their highest educational level (see Table 1).

Does the Vocational/Technical Diploma Category Fit in the Attainment Continuum?

The results summarized in Table 2 show that "regular" academic attainment for vocational diploma recipients varies widely, which suggests quite clearly that vocational/technical education does <u>not</u> belong in the regular education continuum. Attempting to force a place for it in the regular education continuum will certainly cause problems for some respondents in attempting to report their "highest" educational attainment. As discussed above, it is also very likely to result in lost information about such training, in particular from persons with high level post-secondary degrees. In MP2001 and MP2002 field tests, 21% (47/227) and 37% (136/370) of vocational/technical diploma recipients in our test treatment groups reported their highest educational attainment as an associate degree or above.

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order to avoid keying errors. Of particular concern in this regard are categories 39 ("12th grade, no diploma"), and 40 ("HIGH SCHOOL GRADUATE (diploma or GED or equivalent)"). Allowing the numeric codes entered into the computerized questionnaire to match the grade level reported by the respondent would lead to difficulty – and error – at precisely this point in the continuum.

[3] In addition to the new attention focused on vocational training, other changes in the MP response categories also represent differences in attention between the current SIPP instrument and the MP instrument (See Appendix A). There are two major changes: (a) The MP instrument offers two separate response categories for persons with "some college" - (40- 'Some college credit, but less than one year' and 41- 'one or more years of college, but no degree') where the current SIPP instrument only has one: (40- 'Some college but no degree'). This is in response to analytical demands from SIPP users to separate persons with less than 1 year of college experience from those with 1 or more years of college. This enables analysts to better distinguish very brief, "drive-by" post-high-school education with something much more substantial, but still below a college degree. (b) The second re-focusing type of change is in the reverse direction. The MP instrument has collapsed into one response option (43- Associate (2-yr) college degree), with what is now two separate options in SIPP (42- Associate degree in college - Occupational/vocational program and 43-Associate degree in college - Academic program.) Prior research conducted by the Census Bureau indicated that the distinction between these two categories is not clear to the interview participants – one reinterview study, for example, found that about one-third of those reporting a particular type of associate degree chose the other category during reinterview. Additional justification for collapsing the categories is Census Bureau analysts' confirmation that the distinction is not important for their work.

Impact on Item Nonresponse

Table 3 summarizes the impact of eliminating the vocational/technical training response category on nonresponse ("don't know," "refused," "other") to the attainment question. One immediately obvious fact: nonresponse is not a particularly important problem. However, Table 3 does suggest that the benefits of eliminating vocational/technical training from the standard educational attainment response array, and collecting separate information on such training, may come at the cost of a slight increase in item nonresponse. In all three field tests, the nonresponse to the attainment question was significantly higher in the test treatment compared to the control.

Question Order

As noted earlier, the elimination of vocational/technical education as a response category in the main attainment question, and its reincarnation as a separate question, led to the issue of the appropriate placement of the new question – before or after the main educational attainment question. We experimented with the ordering of the new vocational training question in the MP2000 and MP2001 field tests. In the former we asked about vocational or technical education after asking about the person's highest level of "regular" schooling, and only asked the question of respondents age 18+ who reported less than an associate degree; in MP2001 we reversed the order of the questions, and asked the vocational or technical question of all respondents age 18+. The latter test also included a follow-up question asking respondents who reported having received a vocational/technical diploma or certificate to specify both the subject of study and the type of diploma or certificate received. Item nonresponse was not affected by the placement of the new vocational training questions (data not shown).

However, qualitative analysis of the write-in responses to the vocational training question offers some evidence that, when placed before the educational attainment question, some respondents had difficulty later reporting their educational attainment, especially when it fell outside 'regular' school training. For instance, some respondents misreported their "regular" education (e.g. MBA, registered nursing) as vocational/technical training, and then failed to report that training in response to the standard attainment question, thus misreporting their true "regular" attainment status.

Reduce Screen Clutter

As noted, a second goal of this research was to try to reduce the cluttered appearance of the current educational attainment screen's response options. We tested the split screen format in MP2000 and MP2001. We compared the item non-response rate of the HSGRAD format question to that of the experimental one-screen educational attainment format. Although it may have reduced clutter, t-test results indicate that the HSGRAD format resulted in significantly elevated nonresponse (4.5%, versus 2.6% in the test treatment's one- screen format, $p<.01$). The primary cause of this difference was an increase in ambiguous/unusable "other" responses to the follow-up attainment question. Analysis of the "other" category write-ins suggest that almost all of them could have easily fit into one of the pre-coded response categories, and that most "other's" that followed a "no" response to HSGRAD actually indicated completion of a high school degree or its equivalent or more – in fact, about half reported completion of a college degree! On the other hand, the standard, one-screen educational attainment question in the test treatment yielded very few "other" responses, which mostly indicated genuinely ambiguous or difficult to code situations.

These data suggest that the two-part method, especially in concert with the "other" response option, and especially with the "before" positioning of the educational attainment question, may introduce more error and reduce data quality. They certainly hint strongly that the new format causes great problems for persons who might not have formally completed high school, but also those whose education continued on beyond high school nonetheless. Furthermore, during debriefing sessions, some interviewers reported that the HSGRAD format not only adds an extra, non-essential question, but also one that made some respondents – especially those who had not completed high school – somewhat uncomfortable. Therefore, although the HSGRAD screener approach clearly resulted in a less cluttered appearance on the screen, the negative consequences of this design modification are rather substantial.

Conclusions and Recommendations

Results of this research suggest quite clearly that important information on vocational technical training is missed by trying to fit vocational/technical training in the continuum with "regular" academic attainment. Eliminating the response option and adding separate vocational training questions both reduces ambiguity and provides analysts with new and useful data about an important area of education. Our results suggest that the traditional vocational diploma response category severely underestimates the extent of such training and does not provide sufficient data on the educational attainment of respondents who have such training. Interviewers in the several MP field tests also reported that respondents liked the separate vocational training questions, because many felt it was an important aspect of their overall educational attainment. We do note that the trade-off of eliminating the vocational training category is a slightly higher rate of item nonresponse. Our results indicate that the placement of the new vocational training questions has no statistically significant impact on item non-response. However, given our qualitative analyses on the potential reporting error with the 'before' positioning

of the vocational training questions, we favor the "after" position. We do note the wordings used in the vocational training questions for our field tests, "...a vocational, technical, trade, or business school" may result in some respondents mistakenly reporting having had technical/vocational training while such training has led to their highest regular academic degrees. This may account for some of the large differences in the percentage of respondents who reported having had vocational training between our control and test instruments. To avoid such potential error, we added a new interviewer's instruction in the vocational training question (VOCAT) (see Appendix C).

With regard to the two-stage approach to educational attainment measurement, the evidence suggests that this format did not work well enough to earn our endorsement. Most importantly, it appeared to increase the likelihood of nonresponse (primarily through an increase in unuseable "other" responses), to cause problems for persons who have not followed a standard course of formal education, and to produce a negative reaction among some respondents, especially those with less than a high school education. Thus, the single screen educational attainment question is the preferred format. Based on the above findings, we adopted the question and response format shown in the Appendix C for the attainment series in the revised production SIPP instrument to be fielded in 2004.

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_____2002. http://www.census.gov/population/socdemo/education/tabA-1.pdf. Table A-1. Years of School Completed by People 25 Years Old and Over, by Age and Sex: Selected Years 1940 to 2002

Table 1. Respondents Reporting Vocational/Technical Certificate or Diploma in MP2001 and MP2002 Field Tests

	Control Instrument	Test Instrument
Design:	All-on -one screen educational attainment format with vocational technical degree listed as a response category	Separate vocational and technical training questions on attendance and receipt of diploma and certificate
Number of adults age 18 or above	4021	3694
Number attended vocational school	133 (3.3%)	799 (21.6%)
Number receiving certificate and diploma	133 (3.3%)	597 (16.2%)

Table 2. Highest Educational Attainment of Test-Treatment Respondents who Reported Receiving Vocational/Technical Training

Highest Educational Attainment	MP2000* (N=1053)		MP2001 (N=1558)		MP2002 (N=2136)	
	Number attended vocational school	Number attended and received a diploma	Number attended vocational school	Number attended and received a diploma	Number attended vocational school	Number attended and received a diploma
< 7th grade	0 (0%)	-	3 (1.0%)	2 (1.0%)	0 (0%)	-
7th - 12th , no diploma	28 (10.8%)	14 (7.1%)	18 (5.9%)	10 (4.4%)	31 (6.3%)	17 (4.3%)
High school	136 (52.3%)	97 (53.0%)	136 (44.3%)	101 (44.5%)	183 (37.2%)	135 (36.5%)
< 1 year of college	48 (18.5%)	32 (17.5%)	38 (12.4%)	31 (13.7%)	65 (13.2%)	44 (12.0%)
1+ years of college	47 (18.1%)	39 (21.3%)	49 (16.0%)	29 (12.8%)	76 (15.5%)	59 (16.0%)
Associate degree	-	-	27 (8.8%)	25 (11.0%)	64 (13.0%)	63 (17.0)%
Bachelor's	-	-	20 (6.5%)	17 (7.5%)	55 (11.2%)	40 (11.0%)
Master's	-		6 (2.0%)	3 (1.3%)	12 (2.4%)	8 (2.2%)
Professional	-		2 (0.7%)	1 (0.4%)	3 (0.6%)	3 (0.8%)
Doctorate	-		1 (0.3%)	1 (0.4%)	2 (0.4%)	1 (0.3%)
Other	0 (0%)	-	7 (2.3%)	7 (3.1%)	-	-
D/R	1 (0.4%)	1 (0.6%)	0 (0%)	-	1 (0.2%)	1 (0.3%)
Total	260 (100%)	183 (100%)	307 (100%)	227 (100%)	492 (100%)	370 (100%)

*In 2000 field test, vocational training question was limited to adults with educational attainment less than an associate degree

Table 3. Percentage of Item Nonresponse* in Control and Test Treatment Groups in Three Field Tests

	MP2000		MP2001		MP2002		TOTAL, all field tests	
	Control	Test	Control	Test	Control	Test	Control	Test
Item Nonresponse Rate (N)	1.65 % (25)	3.5% (55)	2.4% (43)	4.2% (67)	1.25% (28)	2.02% (44)	1.73 %	3.12%
Significance level	.01		.02		.07		0.002	

*Includes "Don't know', 'Refused' and 'Other' responses.

Appendix A. Educational attainment questions: Test versus Control instruments

Control (EDUCA)	Test (EDUCA)	Test (split screen version)
What is the highest level of school [NAME] has completed or the highest degree he/she has received? (31) Less than 1st grade (32) 1st, 2nd, 3rd grade (33) 5th or 6th grade (34) 7th or 8th grade (35) 9th grade (36) 10th grade (37) 11th grade (38) 12th grade, no diploma (39) HIGH SCHOOL GRADUATE (diploma or GED or equivalent) (40) Some college but no degree *(41) Diploma or certificate from a vocational, technical, trade or business school beyond the High School level (42) Associate degree in college - Occupational/vocation program (43) Associate degree in college - Academic program (44) Bachelor's degree (For example: BA, AB, BS) (45) Master's degree (For example: MA, MS, MENG, Med, MSW, MBA) (46) Professional School degree (For example: MD(doctor), DDS(dentist), JD(lawyer)) (47) Doctorate degree (For example: Ph.D., Ed.D.)	(Other than vocational training) what is the highest level of school [NAME] has completed or the highest degree he/she has received? (31) Less than 1st grade (32) 1st, 2nd, 3rd grade (33) 5th or 6th grade (34) 7th or 8th grade (35) 9th grade (36) 10th grade (37) 11th grade (38) 12th grade, no diploma (39) HIGH SCHOOL GRADUATE (diploma or GED or equivalent) (40) Some college credit, but less than 1 year (41) 1 or more years of college, no degree (regular Jr. coll./coll./univ.) (43) Associate (2-yr) college degree (include academic/occupational degree) (44) Bachelor's degree (for example: BA, AB, BS) (45) Master's degree (for example: MA, MS, MENG, Med, MSW, MBA) (46) Professional School degree (for example: MD(doctor),DDS(dentist),JD(lawyer)) (47) Doctorate degree (for example: Ph.D., Ed.D.) **(48) Other (Specify)	HSGRAD Has [NAME] graduated from high school (or the equivalent -- for example, completed high school by means of a GED))? Less than higher school -> goto NOGRAD High school -> goto YESGRAD NOGRAD Other than vocational training) what is the highest level of school [NAME] has completed? Listed responses: (31 to 38) **(48) other (specify) YESGRAD Other than vocational training) what is the highest level of school [NAME] has completed or the highest degree he has received? Listed responses: (39 to 48**)

*No vocational training question, vocational degree is put into the educational attainment continuum.
**The 'Other' response is only added for testing purposes, this category is removed for the SIPP 2004 Panel Instrument.

Appendix B: Test Treatment New Vocational Training Questions by Field Tests.

	First Field Test (MP2000)	Second Field Test (MP2001)	Third Field Test (MP2002)
Universe	All persons 18 & above with educational attainment less than or equal some college	All persons 18 & above	All persons 18 & above
Position	After standard attainment question	Before standard attainment question	After standard attainment question
>VOCAT<	Has [name] ever attended a. vocational, technical, trade, or business school?	Excluding regular schools and colleges, has [NAME] ever attended a vocational, technical, trade, or business school beyond high school?	Has [NAME] ever attended a vocational, technical, trade, or business school beyond high school?
>YESVOC<	Has [name] received a diploma or certificate from a vocational, technical, trade, or business school?	Has [NAME] received a diploma or certificate from a vocational, technical, trade, or business school?	Has [NAME] received a diploma or certificate from a vocational, technical, trade, or business school?
>YESVOC_SP<		Please specify the subject and types of diploma or certificate received.	

Appendix C: Educational Attainment and Vocational Training Question for SIPP 2004 Panel Instrument

>EDUCA<
What is the highest level of school [NAME] has completed or the highest degree he/she has received?

Responses 31 to 41
Responses 43 to 47 (see Appendix A middle column)

>VOCAT<

Has [Name] ever attended a vocational, technical, trade, or business school beyond high school?

"BUSINESS SCHOOLS" TEACH SKILLS OR TRADES SUCH AS SECRETARIAL TRAINING, BOOKKEEPING, COMPUTER PROGRAMMING, ETC. DO *NOT* INCLUDE BUSINESS PROGRAMS IN COLLEGES AND UNIVERSITIES LEADING TO ACADEMIC DEGREES.

(1) Yes
(2) No

>YESVOC<

Has [NAME] received a diploma or certificate from a vocational, technical, trade, or business school?